

ICRISAT in West Africa



ICRISAT

**International Crops Research Institute for the Semi-Arid Tropics
ICRISAT Saheian Center, B.P. 12404, Niamey, Niger**

Cover: Model of the ICRISAT Sahelian Center, Sadoré, Niger.

The International Crops Research Institute for the Semi-Arid Tropics is a nonprofit scientific educational institute receiving support from donors through the Consultative Group on International Agricultural Research. Donors to ICRISAT include governments and agencies of Australia, Belgium, Canada, Federal Republic of Germany, Finland, France, India, Italy, Japan, Mexico, Netherlands, Nigeria, Norway, People's Republic of China, Sweden, Switzerland, United Kingdom, United States of America, and the following international and private organizations: Asian Development Bank, Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), Global 2000, Inc., International Development Research Centre, International Fertilizer Development Center, International Fund for Agricultural Development, The European Economic Community, The Ford Foundation, The Leverhulme Trust, The Opec Fund for International Development, The Rockefeller Foundation, The World Bank, United Nations Development Programme, and the University of Hohenheim. Information and conclusions in this publication do not necessarily reflect the position of the aforementioned governments, agencies, and international and private organizations.

scientists. Begun in June 1986, construction work on the campus should be complete by June 1988. This 700 m² complex will house laboratories, a library, a conference room, administrative offices, a cafeteria, a germplasm bank, and service workshops.

About 400 ha of the experimental site is reserved for crops. Of this, nearly 90 ha can be irrigated, if drought occurs during the rainy season, and 20 ha can receive off-season irrigation to speed up breeding work.

The remaining 100 ha will be used to set up the main buildings of the Center, a meteorological station, a plant quarantine unit, tree and shrub nurseries, agroforestry studies, and land regeneration studies (conducted within a fenced area of 15 ha left in its natural state since 1981).

ICRISAT will also develop a training center for students and visitors, with housing facilities for 18 persons. This center will train scientists and technicians from West African national programs.

Research and Support Programs

Pearl Millet Improvement

Pearl millet is by far the main cereal of the Sahelian zone, where it might have been introduced more than 7000 years ago. It now forms the staple diet of the Sahelian population. It is the last major cereal cultivated before conditions become too arid for arable farming. In 1982, the West African pearl millet production was assessed at 8 million tonnes, produced on 14 million hectares, corresponding to an average yield of 550 kg/ha. Pearl millet production in the Sahelian zone represents 78% of the African production and 50% of the world production.

To help increase and stabilize millet production in the region, ICRISAT's pearl millet improvement program aims to make available to national programs adapted varieties and genotypes with a high yield potential. The program will identify and use sources of resistance to biological and physical stresses to achieve stable yields in such materials that are made available to national programs.

Scientists of this interdisciplinary team work within the framework of the following research areas:

- genetics,
- entomology,

substantial regional approach. The institute's main West African base will be at the ICRISAT Sahelian Center, in Niger, for research on pearl millet, groundnut, and resource management systems, as well as for training. The regional sorghum program, presently located in Burkina Faso, will be strengthened and relocated in two neighboring countries: Mali, representing the wetter sorghum-growing areas; and Nigeria, the drier sorghum-growing areas.

The experience acquired by ICRISAT over the last 10 years has proved to be extremely valuable in establishing these regional programs which will enable the entire region to benefit from its research.

ICRISAT, therefore, recognizes the need to consolidate its research effort in West Africa. This region, affected by serious droughts for over 15 years, covers a quarter of the world's SAT. Nearly 80% of the population in these areas practices subsistence farming. The gross national products (GNP) of these countries are very low and population growth among the highest in the world. This is the only region in the world where the per capita food production has declined during the last 20 years.

ICRISAT Sahelian Center

The ICRISAT Sahelian Center is located at Sadoré (13°N, 2°E) about 40 km to the south-west of Niamey, near Say, Niger. The Government of Niger has made available to ICRISAT 500 ha of land for construction of the Center. This station is the only one besides ICRISAT Center, India, where ICRISAT has sole charge of the experiment site.

This site is representative of the Sahelian zone: with very sandy soils (90%); exposed to wind erosion and soil surface temperatures soaring up to 60°C; average annual rainfall of 560 mm; and a 90-day growth cycle for rainfed crops.

Research work at this site started in 1981, with the appointment of four scientists. By 1986, over 20 scientists were working there.

The foundation stone of the Sahelian Center was laid on 16 August 1983. The ceremony was attended by dignitaries from the Nigerien Government, officials from international organizations, members of the diplomatic corps, representatives of donors, and many scientists.

ICRISAT organized a Special Donors' Meeting in Niamey from 4 to 6 September 1985 and was able to raise funds necessary for the construction of a U.S. \$7.5 million complex that could accommodate more than 250 people, including some 30 international

2

and the Agricultural Research Corporation (ARC) at Wad Medani, Sudan.

Initially, ICRISAT scientists thought that the factors limiting pearl millet and sorghum production must be appreciably similar in Africa and India and that it would therefore be possible to transfer technology without constraints. However, it soon became evident that the farming systems and genetic material developed in India were not particularly well adapted to African conditions, especially in West Africa, although African genetic traits had been incorporated into the new genotypes. Unadapted crop cycles and susceptibility to diseases, insect pests, and the parasitic weed, *Striga hermonthica*, were some of the problems observed. Moreover, these genotypes did not perform well under various constraints that affect the establishment of plant cover, e.g., high soil temperatures, very low fertility levels, sand storms, and erratic rainfall. Confronted with such conditions, ICRISAT scientists intensified their work on African varieties and succeeded in developing promising genetic material.

Several improved ICRISAT cultivars were released in Sahelian Africa: pearl millet varieties ICMV 2 (IBV 8001), ICMV 3 (IBV 8004), and IBMV 8401 in Senegal; pearl millet varieties ICMV 5 (ITMV 8001), ICMV 6 (ITMV 8002), and ICMV 7 (ITMV 8304) in Niger; sorghum varieties E 35-1 and Framida in Burkina Faso; and the sorghum hybrid Hageen Durra 1 and pearl millet Ugandi in Sudan.

Over the years, ICRISAT has been able to establish close cooperative links with the national programs, while reinforcing national infrastructures. For example, the Cinzana Research Station in Mali was set up with ICRISAT's cooperation. The ICRISAT-Mali cooperative program made significant progress with assistance from the United States Agency for International Development (USAID). Cooperation with the regional and international organizations has also been very successful. ICRISAT works closely with the Institut du Sahel (INSAH) of the Comité Permanent Inter-Etats de Lutte Contre la Sécheresse dans le Sahel (CILSS) and the Semi-Arid Food Grain Research and Development (SAFGRAD).

Second Phase of Research

Regional Programs

ICRISAT's long-term objectives to strengthen the national research programs in West Africa is now founded on a much more

ICRISAT in West Africa

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) has a mandate to improve rainfed agriculture in the semi-arid tropics (SAT), which encompasses parts of 50 nations in five continents. The SAT is populated by about 750 million people.

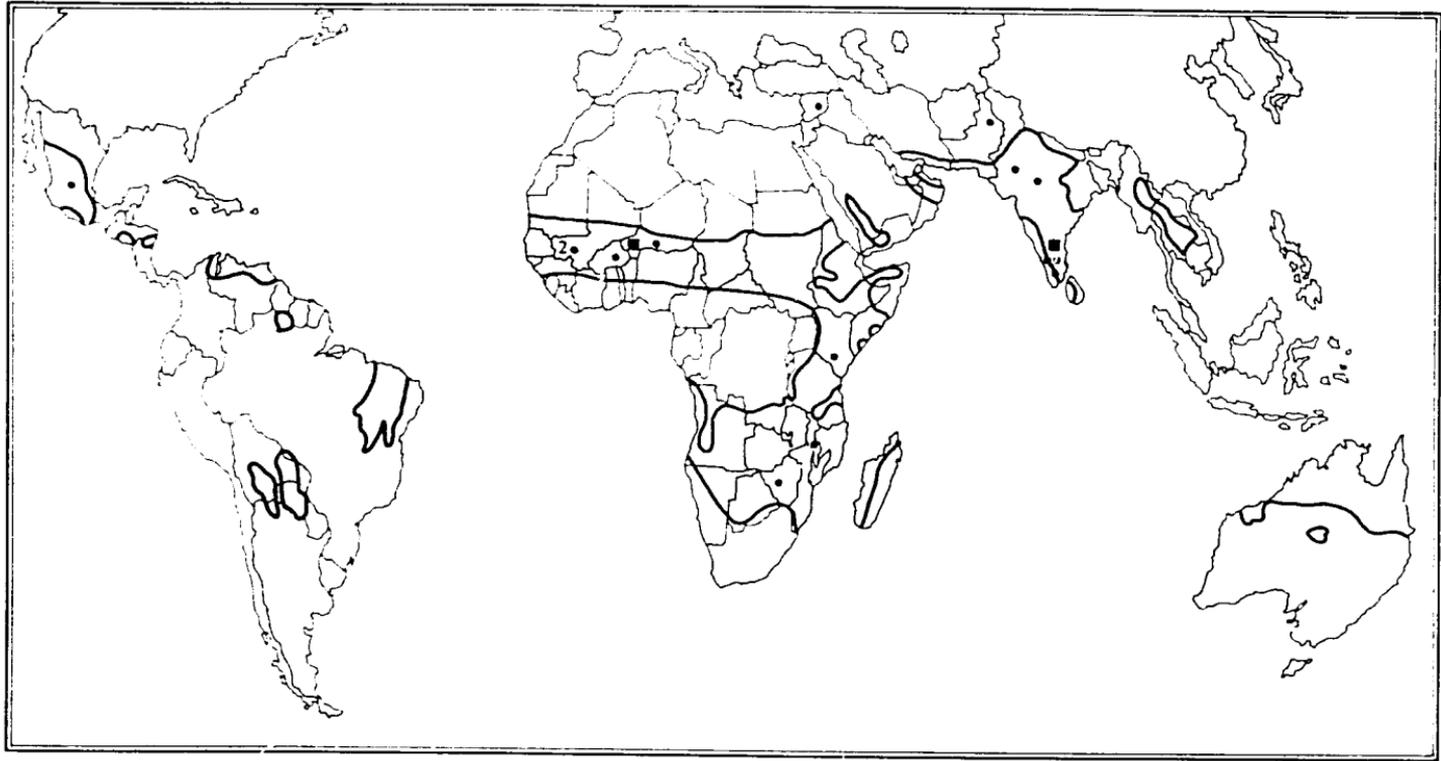
ICRISAT has been given the task of breeding improved, high-yielding, and more stable varieties of five crops basic to life in the SAT—pearl millet, sorghum, groundnut, chickpea, and pigeonpea—as well as developing more productive farming systems, analyzing socioeconomic constraints to the adoption of new techniques, and ensuring dissemination of its research results.

ICRISAT's headquarters are at Patancheru, India. Founded in 1972, the Institute was the first international center to be created by the Consultative Group on International Agricultural Research (CGIAR). ICRISAT joined four already existing institutions in a CGIAR network, which has subsequently expanded to include 13 centers. The CGIAR is sponsored by the World Bank, the Food and Agriculture Organization of the United Nations (FAO), and the United Nations Development Programme (UNDP). The CGIAR is also funded by several other international/regional organizations, governments, and private foundations.

First Phase of Research

ICRISAT within the National Programs

In 1975, ICRISAT started its research activities in Africa. Its primary effort was directed at improving sorghum and pearl millet. ICRISAT was able to temporarily post researchers in seven African countries—Senegal, Mali, Burkina Faso, Nigeria, Niger, and Sudan—with funds, mainly from UNDP. These scientists have been posted at the national research stations of the following institutions—the Institut Sénégalais de Recherches Agricoles (ISRA) at Bambey, Senegal; the Institut d'Économie Rurale (IER) at Sotuba, Mali; the Institut d'Études et de Recherches Agricoles (INERA) at Kamboinsé, Burkina Faso; the Institute for Agricultural Research (IAR) at Samaru, Nigeria; the Institut National de Recherches Agronomiques du Niger (INRAN) at Maradi, Niger;



Semi-arid areas (shaded) covered by ICRISAT's mandate. Squares indicate location of ICRISAT Center in India and Sahelian Center in Niger; dots indicate collaborative research stations where ICRISAT scientists have been posted.

ICRISAT in West Africa



ICRISAT
International Crops Research Institute
for the Semi-Arid Tropics
ICRISAT Sahelian Center, B.P. 12404, Niamey, Niger

1987



Seed multiplication plots of ICMV 7 (ITMV 8304), one of the three pearl millet cultivars released in Niger, in collaboration with the national program.

- physiology,
- breeding,
- plant pathology,
- agronomy, and
- regional trials.

Research on pearl millet is also conducted in the Sudano-sahelian zone.

The highlights of research have been the development of screening techniques for resistance to insects, diseases, high soil-surface temperatures, and to drought; systematic evaluation and characterization of a large part of the world millet collection, and its utilization for the creation of improved varieties and hybrids; collection and conservation of germplasm. The encouraging results obtained will enable breeding of high-yielding genotypes. The program has also helped establish a collaborative research network between millet scientists of the different West and Central African countries; workshops and field visits are organized in different countries of the region within this network.

Groundnut

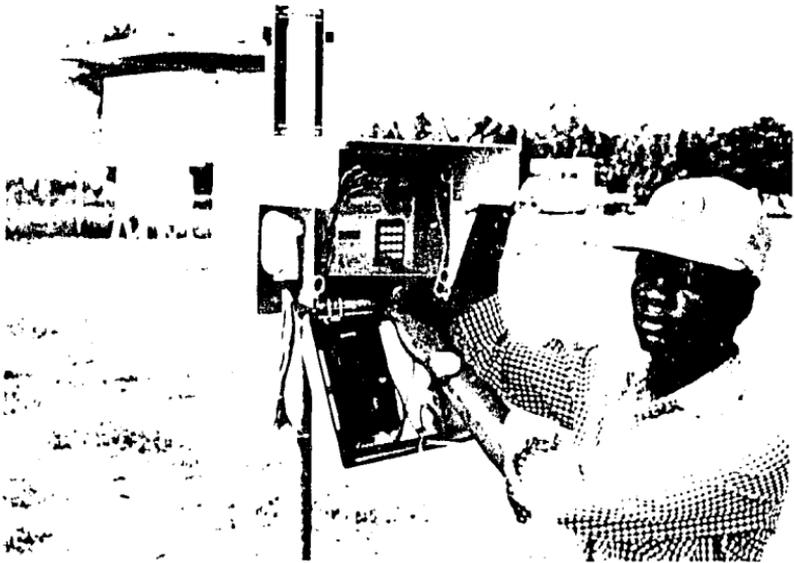
Groundnut has traditionally been a major cash crop in West Africa. It is a rich source of protein, oil, and livestock feed. The nodules produced on its roots fix nitrogen and hence improve the soil. The major constraints to groundnut production in West Africa include lack of high-yielding adapted cultivars, unreliable rainfall patterns with recurring droughts, damage by pests and diseases, and poor agronomic practices. Certain countries which were former exporters of groundnut have now become importers, and in other countries the traditional varieties are no longer well adapted to current climatic conditions.

The groundnut program of the Sahelian Center began in 1986. It covers breeding, agronomy, and pathology. Particular importance is given to rosette, a serious groundnut virus disease specific to Africa. These problems will be addressed in collaboration with national programs, through an interdisciplinary team, consisting of a plant breeder, a plant pathologist, and an agronomist.

Research work is still in the initial stages, but the Sahelian Center has already organized an International Symposium on the Agronomy of Groundnut with the participation of nearly 80 scientists from 21 countries. The symposium reviewed the present status of world groundnut research.



An ICRISAT scientist (right) discusses the benefits of improved groundnut varieties and cropping practices.



A worker operates an instrument used in studies of agroclimatology - an important component of the Resource Management Program.

Resource Management

The Sahel is one of the most difficult environments for agricultural production. Many of its problems are well known, and their solution constitutes a challenge for humanity - successive droughts with serious consequences for agriculture and animal production, desertification, degradation of soils, very low levels of mechanization, and a lack of capital.

The objective of the resource management program is to develop improved farming systems that make better use of human, natural, and animal resources than the traditional system. The different disciplines involved in this effort are:

- agroclimatology,
- fertilizer management,
- soil tillage,
- cropping systems,
- animal traction and animal nutrition,
- agroforestry,
- economics, and
- evaluation of promising technologies.

Village-level studies have been conducted since 1982 in some villages of Niger, where the most promising technologies are being evaluated in cooperation with the farmers.

In cooperation with the national organizations, ICRISAT scientists have analyzed long-term climatic data recorded at many places in Niger, Mali, and Burkina Faso, to determine rainfall probabilities and water balance. This information, essential to agricultural planning, has been published by ICRISAT. Considerable progress has also been achieved with partially acidulated natural phosphate, which is almost as effective as imported commercial formulations and can be produced locally thus reducing import costs. Phosphorus is the most limiting mineral element in West African agriculture; however, it is abundantly available in this region. Promising results have also been obtained on millet and cowpea intercropping, widespread in Sahelian Africa. Promising cowpea varieties (grown for human and animal nutrition) have been identified for such a cropping system. The agroforestry and agropastoral studies are also expected to have considerable impact.

Training

Since 1974, more than 340 researchers and technicians from West Africa received training at ICRISAT Center in India; most are now working with national and regional programs in their respective countries.

In West Africa, ICRISAT scientists are involved in training activities, especially in guiding/supervising the projects and dissertations of students from technical institutes and agricultural universities.

The appointment of a training officer and the construction of the training Center will provide further support to this activity, essential to agricultural development in the region.

Information and Documentation

At the Sahelian Center, the results of research are disseminated in French and in English, so as to be fully accessible to scientists in the region. ICRISAT also publishes scientific handbooks/guides for scientists and technicians, which are now widely used in the developing countries.

Regional Sorghum Program

In West Africa, sorghum is produced in more than 15 countries, particularly in the Sudanian and Northern Guinean bioclimatic zones, where it constitutes one of the most important crops.

The regional sorghum program in West Africa will have scientists working on breeding, physiology, agronomy, pathology, entomology, and economics.

During a workshop on sorghum, held at Ouagadougou, scientists set up a regional sorghum research network and a working group on transfer of technology. This network brings together scientists of national, regional, and international programs, thus contributing to a more rapid development of this crop.

Other ICRISAT Research in Africa

ICRISAT has also established a regional sorghum and millet improvement program at Matopos, in Zimbabwe, for the benefit of the member countries of the Southern African Development Coordination Conference (SADCC); a regional groundnut improvement program at Lilongwe, in Malawi, for eastern and southern Africa; and a program for coordination of sorghum and millets research in eastern Africa, at Nairobi, Kenya, in cooperation with SAFGRAD.

The Documentation Service of the Sahelian Center will emphasize literature in French and complement the services of ICRISAT Center library. The Documentation Service will be a nodal point of Semi-Arid Tropical Crops Information Service (SATCRIS) and will provide document delivery and bibliographical services to scientists in the region.

Other Support Programs

The Sahelian Center has administrative services, statistics and computer services, a civil engineering department for the construction of the Center, and a farm development service.

Cooperative Research

Research at the ICRISAT Sahelian Center is not only interdisciplinary but also cooperative, and several international organizations are directly participating in the research by posting scientists at the Sahelian Center: the International Institute of Tropical Agriculture (IITA), for cowpea; the International Livestock Center for Africa (ILCA), for agropastoral studies; the University of Wageningen, for soil tillage; the University of Hohenheim, for agronomy; the International Fertilizer Development Center (IFDC), for phosphatic fertilizers; the Institut Français de Recherche Scientifique pour le Développement en Coopération (ORSTOM), for millet genetics. ICRISAT is also cooperating with other research institutions having similar interests—the Centre Régional de Formation et d'Application en Agrométéorologie et Hydrologie Opération (AGRHYMET), the Comité Permanent Inter-Etats de Lutte Contre la Sécheresse (CILSS), the Semi-Arid Food Grain Research and Development (SAFGRAD), the Institut de Recherches Agronomiques Tropicales et des Cultures Vivrières (IRAT), the Institut de Recherches pour les Huiles et Oléagineux (IRHO), and the International Board for Plant Genetic Resources (IBPGR)—and for more than 10 years with the national programs, which are the main beneficiaries of ICRISAT's research.